

Supercapsular Percutaneously-Assisted Total Hip (SuperPATH®) Approach – A Review of the Literature



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Introduction

SuperPATH® is a modification of the standard posterior approach. SuperPATH® is a portal assisted minimally invasive tissue-sparing surgical approach for hip arthroplasty which utilizes elements of the “SuperCap” approach (Dr. Stephen Murphy) and the “PATH” approach (Dr. Brad Penenberg). Similar to the “SuperCap” approach, SuperPATH® accesses the capsule superiorly through the interval between the gluteus minimus and piriformis with the potential not to cut any muscles or tendons. The femur is prepared with the head and neck intact reducing the chance of fracture. Similar to the “PATH” approach, the acetabulum is prepared under direct visualization and a cannula facilitates the use of inline instrumentation simplifying impaction of the acetabular component as well as the insertion of screws. If necessary, there is an extensible option allowing surgeons to continue the technique from a familiar view without repositioning the patient. The SuperPATH® approach does not require any muscle release and preserves the external rotators with the objective of allowing patients to become fully functioning at a faster rate than with traditional surgical approaches.

The goals of any tissue sparing approach can be observed from a patient and from a surgeon’s point of view. For patients, pain relief, early postoperative function, and improved satisfaction are the main goals. For surgeons, a safe and reproducible procedure, well positioned components, and minimizing complication rates are most important.

This comprehensive overview summarizes the findings from clinical studies involving the SuperPATH® hip approach. Four types of clinical studies are included:

- Studies describing the **SuperPATH® learning curve** – showing that SuperPATH® is a technique that can be implemented safely without an increase in complications
- Studies **comparing SuperPATH® outcomes to other traditional surgical approaches** including randomized- and case-controlled trials, prospective and retrospective studies, gait analyses, meta-analyses, and economic studies
- Studies providing **SuperPATH® multi-center results** – demonstrating that excellent SuperPATH® results are achievable in different hospital settings, healthcare systems, and annual volumes without an increase in complications
- Studies utilizing **SuperPATH® with a Rapid Recovery Protocol** – demonstrating the ability to further accelerate patient’s functional recovery, optimize patient satisfaction, and accelerate patient discharge

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SuperPATH® Learning Curve

A move toward minimally invasive hip arthroplasty is in line with the desire to reduce postoperative pain, speed up early recovery and function, as well as to reduce complications. An ideal “micro” posterior approach would provide a continuum to a “mini” (external rotator sacrificing) posterior approach to a standard posterior approach which could keep a surgeon within his comfort zone during the learning curve of the procedure, while leaving options for complicated reconstructions for the more practiced micro-posterior surgeons [1]. Once a new technique is adopted, it can be expected that a surgeon may experience an increase in operative time which can be expected to decrease over time as the surgeon becomes more familiar with the technique; however, the surgeon should be aware to not adopt a new technique at the expense of increased patient complications. As shown in Table 1, several studies from the United States, Europe, and Australia have shown low complication rates, high patient satisfaction, and low patient length of stay during surgeons’ initial learning curve phase suggesting surgeons should not expect to have to compromise patient outcomes in order to become acquainted with the SuperPATH® hip approach.

Table 1. Summary of findings from clinical studies reporting outcomes for SuperPATH® procedures during the learning curve period

Study	Variables Measured	Cohort	Key SuperPATH® Findings
Rasuli and Gofton - [2]	LOS, Operative Variables, and Complication Rates	50 SP, 50 PATH	<ul style="list-style-type: none"> - Mean operative time continued to decrease until case 50 - Transfusion rates were low (6%) - Mean length of stay was relatively low (2.2 days) with 20% discharged on Day 1, 64% by Day 2, and 96% by Day 3 - Complication rates were low (4%)
Della Torre - [3]	Radiographic Assessment by Independent Orthopaedic Surgeon	66 of first 100 SP cases	<ul style="list-style-type: none"> - All components were well seated and position was deemed optimal for described THA safe zones - Leg lengths were measured to within 5mm of the contralateral side
Howles - [4]	LOS, Operative Variables, and Complication Rates	First 100 SP cases	<ul style="list-style-type: none"> - The results suggest the learning curve was limited to operative time and blood loss - Complications were evenly distributed throughout the study period and are of similar frequency to standard approaches - As the first European centre to adopt SP, we have shown the published results from America can be reproduced - In contrast to the direct anterior approach, the learning curve is not associated with higher rates of femoral fracture and other complications
Qurashi – 2016 [5]	LOS, Operative Variables, and Complication Rates	First 100 SP cases	<ul style="list-style-type: none"> - Complications were spread out throughout the case series, without any identifiable learning curve correlation - 100% of patients were extremely satisfied with the operation

LOS: Length of Stay; SP: SuperPATH®

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In 2017, a poster was presented at EFORT by Gofton et al. [6] in which four non-designer surgeons in three different countries (U.S., Canada, and the United Kingdom) retrospectively reported outcomes from their first 50 SuperPATH® cases (Table 2). The authors concluded that the SuperPATH® approach can be implemented by non-designer surgeons in different hospital settings, healthcare systems, and annual volumes without an increase in complications.

Table 2. Outcomes of first 50 cases for each of the four non-designer surgeons [6]

Variable	Community Hospital – U.S.	Large Metro Hospital – U.S.	University Hospital - Canada	University Hospital – U.K.
Length of Stay	2.1 days	2.5 days	2.2 days	2.8 days
Transfusion (%)	0%	0%	6%	2%
30-Day Readmission Rate	2%	2%	4%	2%
Discharge Status				
Home	92%	62% †	90%	100%
SNF	8%	2%	8%	0%
Rehab	0%	36%	2%	0%
Complications				
Dislocations	0	0	1 (traumatic)	1
DVT / PE	0	0	0	0
Wound Complications	0	0	0	0
Infections	0	0	0	0
Fractures	2	1	0	1

† Related to the surgeon's conservative approach in his initial cases, having an older patient population, and patients traveling from another city for surgery

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Comparison of SuperPATH® Outcomes to Other Traditional Surgical Approaches

All known studies comparing SuperPATH® to other traditional surgical approaches were located and summarized below. The information from comparison studies is presented in the following categories, separated by if the patient underwent total hip arthroplasty (THA) or hemiarthroplasty (Hemi):

- **Perioperative and Postoperative Recovery Variables** – evaluating patients' perioperative and postoperative recovery variables
- **Component placement and leg length discrepancy** – evaluating proper implant placement and ability to restore the patient's anatomy
- **Patient reported outcome measures (PROMs)** – evaluating patients' self-reported function and quality of life after undergoing a hip arthroplasty procedure via the SuperPATH® approach
- **Economic benefit of SuperPATH®** – evaluating the reduction of total cost of care by adoption of the SuperPATH® technique

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Comparison of SuperPATH® Outcomes to Other Traditional Surgical Approaches

Perioperative and Postoperative Recovery Variables



Perioperative and Postoperative Recovery Variables

Operative Outcomes – Total Hip Arthroplasty

Operative variables reported in comparison studies between SuperPATH® and other traditional approaches for patients undergoing THA are shown in Table 3.

SuperPATH® vs. Traditional Posterior or Posterolateral Approach: Several studies have shown SuperPATH® to be significantly better than the posterior/posterolateral approach for less time of operation, smaller length of incision, less intraoperative blood loss, less postoperative drainage, and lower transfusion rates. Studies have shown there is no difference in time of operation, intraoperative blood loss, and transfusion rates.

SuperPATH® vs. Traditional Anterior or Anterolateral Approach: Studies have shown SuperPATH® to be significantly better for less time of operation, less intraoperative blood loss, and less postoperative drainage.

SuperPATH® vs. Hardinge Approach: Studies have shown SuperPATH® has significantly shorter length of incision, and other studies have shown no differences in postoperative drainage and transfusion rates.

SuperPATH® vs. Other Conventional Approaches: Studies have shown SuperPATH® to be significantly shorter length of incision, less intraoperative blood loss, less postoperative drainage, and lower transfusion rates while other studies have shown no differences in time of operation and transfusion rates.

Table 3. Operative Variable Comparison Between SuperPATH® and Other Approaches *for Total Hip Arthroplasty*

Variable	Anterior/ Anterolateral	Posterior/ Posterolateral	Hardinge	“Conventional Approaches”
Studies Showing SuperPATH® is Significantly Better than Other Approaches				
Time of Operation	-	- [7, 8]	-	-
Length of Incision	- [9]	- [7, 8, 10-13]	- [14]	- [15-18]
Intraoperative Blood Loss	- [9, 19]	- [8, 10, 12, 20]	-	- [15-18]
Postoperative Drainage	- [9, 19]	- [8, 10, 20]	-	- [16]
Transfusion Rate	-	- [10]	-	- [16, 18]
Studies Showing No Difference Between SuperPATH® and Other Approaches				
Time of Operation	-	- [10]	-	- [16-18]
Length of Incision	-	-	-	-
Intraoperative Blood Loss	-	- [7, 13]	-	-

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Comparison of SuperPATH® Outcomes to Other Traditional Surgical Approaches

Perioperative and Postoperative Recovery Variables



Table 3. Operative Variable Comparison Between SuperPATH® and Other Approaches *for Total Hip Arthroplasty*

Variable	Anterior/ Anterolateral	Posterior/ Posterolateral	Hardinge	“Conventional Approaches”
Postoperative Drainage	-	-	- [14, 21]	-
Transfusion Rate	-	- [7]	- [21]	- [15, 17]

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Comparison of SuperPATH® Outcomes to Other Traditional Surgical Approaches

Perioperative and Postoperative Recovery Variables



Recovery Outcomes – Total Hip Arthroplasty

Outcomes reported in comparison studies describing patient recovery after undergoing THA via the SuperPATH® approach or other traditional approaches are shown in Table 4.

SuperPATH® vs. Traditional Posterior or Posterolateral Approach: Studies have shown SuperPATH® is significantly better with shorter length of stay, more early postoperative range of motion, and less unloaded activity time. Additionally, studies have reported SuperPATH® has significantly less unloaded activity time as well as VAS pain, timed up and go, and timed stair climb out to 3 months postoperatively. Other studies have reported no differences in length of stay or range of motion between 2 weeks and 2 years postoperatively.

SuperPATH® vs. Traditional Anterior or Anterolateral Approach: Studies have shown SuperPATH® is significantly better with shorter length of stay. Additionally, studies have reported SuperPATH® has significantly better VAS pain at Day 1, Day 7, and 1 Year postoperatively. Other studies have reported no differences in range of motion, unloaded activity time, or VAS pain at Month 1 and Month 3 postoperatively.

SuperPATH® vs. Hardinge Approach: Studies have shown SuperPATH® has significantly less length of stay and VAS pain between Day 1 and 2 Years postoperatively with no differences in VAS pain at 3 Years postoperatively.

SuperPATH® vs. Other Conventional Approaches: Studies have shown SuperPATH® to have significantly less length of stay, unloaded activity time, and VAS pain at Day 1 and 3 postoperatively with no difference in VAS pain at Day 7 postoperatively.

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Comparison of SuperPATH® Outcomes to Other Traditional Surgical Approaches

Perioperative and Postoperative Recovery Variables



Table 4. Recovery Comparison Between SuperPATH® and Other Approaches *for Total Hip Arthroplasty*

Variable	Anterior/ Anterolateral	Posterior/ Posterolateral	Hardinge	“Conventional Approaches”
Studies Showing SuperPATH® is Significantly Better than Other Approaches				
Mean length of stay	- [9, 19]	- [7, 10, 13]	- [14, 21]	- [22]
VAS Pain	- Day 1 & 7 [9]; - 1 Yr [19]	- Day 1 [11, 20] - Day 3 [11] - Day 7 and 1 Mo [7, 10] - 3 Mo [7]	- Day 1, 3, & 7 [14] - Day 1, 3 Mo, 6 Mo, 1 Yr, 2 Yrs [21]	- Day 1 [17, 18] - Day 3 [17]
Range of Motion	-	- Day 1 & 3 [11]	-	-
Unloaded Activity Time	-	- [8, 12, 20]	-	- [22]
Timed Up And Go Test	-	- Day 5 [12] - Day 7 [7] - 2 Wks [12] - 1 Mo [7, 12] - 2 Mo [12] - 3 Mo [7]	-	-
Timed Stair Climb Test	-	- Day 7, 1 Mo, 3 Mo [7]	-	-
30-Day Readmission Rate	-	-	-	-
Studies Showing No Difference Between SuperPATH® and Other Approaches				
Mean length of stay	-	- [11]	-	-
VAS Pain	- 1 & 3 Mo [9]	-	- 3 Yrs [21]	- Day 7 [17]
Range of Motion	- [9]	- [20] - 2 Wks, 3Mo, 6 Mo, 1 Yr [11]	-	-
Unloaded Activity Time	- [19]	-	-	-
Timed Up And Go Test	-	-	-	-
Timed Stair Climb Test	-	-	-	-
30-Day Readmission Rate	-	-	-	-

Mo: Month; VAS: Visual Analogue Scale; Wks: Weeks; Yrs: Years

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Comparison of SuperPATH® Outcomes to Other Traditional Surgical Approaches

Perioperative and Postoperative Recovery Variables



Operative Outcomes – Hemiarthroplasty

Operative variables reported in comparison studies between SuperPATH® and other traditional approaches for patients undergoing hemiarthroplasty are shown in Table 5.

SuperPATH® vs. Traditional Posterior or Posterolateral Approach: Several studies have shown SuperPATH® to be significantly better than the posterior/posterolateral approach with shorter length of incision, less intraoperative blood loss, less postoperative drainage, and lower transfusion rates. Other studies have shown no differences in time of operation or intraoperative blood loss.

SuperPATH® vs. Other Conventional Approaches: One study has shown SuperPATH® to be significantly better than other conventional approaches with shorter length of incision and less intraoperative blood loss while showing no differences in time of operation.

Table 5. Operative Variable Comparison Between SuperPATH® and Other Approaches *for Femoral Neck Fracture*

Variable	Posterior/ Posterolateral	"Conventional Approaches"
Studies Showing SuperPATH® is Significantly Better than Other Approaches		
Time of Operation	-	-
Length of Incision	- [23-28]	- [29]
Intraoperative Blood Loss	- [24-28, 30]	- [29]
Postoperative Drainage	- [24, 26, 27, 30]	-
Transfusion Rate	- [25]	-
Studies Showing No Difference Between SuperPATH® and Other Approaches		
Time of Operation	- [25, 31]	- [29]
Length of Incision	-	-
Intraoperative Blood Loss	- [31]	-
Postoperative Drainage	-	-
Transfusion Rate	-	-

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Comparison of SuperPATH® Outcomes to Other Traditional Surgical Approaches

Perioperative and Postoperative Recovery Variables



Recovery Outcomes – Hemiarthroplasty

Outcomes reported in comparison studies describing patient recovery after undergoing hemiarthroplasty via the SuperPATH® approach or other traditional approaches are shown in Table 6.

SuperPATH® vs. Traditional Posterior or Posterolateral Approach: Studies have shown SuperPATH® is significantly better with shorter length of stay and shorter unloaded activity time and timed up and go. VAS pain data is inconclusive as some studies show a significantly lower pain score for SuperPATH® between Day 1 and 6 Months while other studies show no differences between Day 7 and 6 Months as well as up to 2 Years.

SuperPATH® vs. Other Conventional Approaches: One study has shown a significantly lower VAS pain score for SuperPATH® at Day 1 and 7 postoperatively with no difference in VAS pain at 3 and 6 Months postoperatively.

Table 6. Recovery Comparison Between SuperPATH® and Other Approaches *for Femoral Neck Fracture*

Variable	Posterior/ Posterolateral	“Conventional Approaches”
Studies Showing SuperPATH® is <i>Significantly Better</i> than Other Approaches		
Mean length of stay	- [24, 27, 31]	-
VAS Pain	- Day 1 [23, 26] - Day 7 [25, 28] - 6 Wks [30] - 6 Mo [24]	- Day 1 & 7 [29]
Range of Motion	-	-
Unloaded Activity Time	- [24-26, 30, 31]	-
Timed Up And Go Test	- [30]	-
Timed Stair Climb Test	-	-
30-Day Readmission Rate	-	-
Studies Showing <i>No Difference</i> Between SuperPATH® and Other Approaches		
Mean length of stay	-	-
VAS Pain	- Day 7, 1 Mo [31] - 3 Mo [25, 28] - 6 Mo & 1 Yr [31] - 2 Yrs [25, 31]	- 3 & 6 Mo [29]
Range of Motion	-	-
Unloaded Activity Time	-	-
Timed Up And Go Test	-	-
Timed Stair Climb Test	-	-
30-Day Readmission Rate	-	-

Mo: Month; Wks: Weeks; Yrs: Years

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Comparison of SuperPATH® Outcomes to Other Traditional Surgical Approaches

Component Placement and Leg Length Discrepancy



Component Placement and Leg Length Discrepancy

Component alignment and leg length discrepancy (LLD) results in studies comparing SuperPATH® to other traditional approaches are shown in Table 7 and Table 8.

SuperPATH® vs. Traditional Posterior or Posterolateral Approach: Multiple studies have shown no differences in component alignment for THA.

SuperPATH® vs. Traditional Anterior or Anterolateral Approach: One THA study has shown SuperPATH® has significantly less LLD. Another THA study showed no differences in component alignment.

SuperPATH® vs. Hardinge Approach: THA studies have shown no differences in component alignment or LLD.

SuperPATH® vs. Other Conventional Approaches: A hemiarthroplasty study showed no differences in component alignment.

Table 7. Studies Comparing Component Alignment Between SuperPATH® and Other Approaches *for Total Hip Arthroplasty*

Variable	Anterior/ Anterolateral	Posterior/ Posterolateral	Hardinge	"Conventional Approaches"
Studies Showing SuperPATH® is Significantly Better than Other Approaches				
Component Alignment	-	-	-	-
Leg Length Discrepancy	- [19]	-	-	- [22]
Studies Showing No Difference Between SuperPATH® and Other Approaches				
Component Alignment	- [9]	- [7, 10, 11]	- [14]	- [16-18]
Leg Length Discrepancy	-	-	- [32]	-

Table 8. Studies Comparing Component Alignment Between SuperPATH® and Other Approaches *for Femoral Neck Fracture*

Variable	Posterior/ Posterolateral	"Conventional Approaches"
Studies Showing SuperPATH® is Significantly Better than Other Approaches		
Component Alignment	-	-
Leg Length Discrepancy	-	-
Studies Showing No Difference Between SuperPATH® and Other Approaches		
Component Alignment	-	- [29]
Leg Length Discrepancy	-	-

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Comparison of SuperPATH® Outcomes to Other Traditional Surgical Approaches

Patient Reported Outcome Measures (PROMs)



Patient Reported Outcome Measures (PROMs)

PROMs – Total Hip Arthroplasty

Patient reported outcome measures (PROMs) results for studies comparing SuperPATH® and other approaches for THA are shown in Table 9.

SuperPATH® vs. Traditional Posterior or Posterolateral Approach: Multiple studies have shown SuperPATH® has significantly higher HHS scores between Day 1 and 3 Months while another study reported no differences at 3 Months and 1 Year. Studies have shown significantly higher Barthel Index scores between Day 1 and 3 Months and SF-36 scores at 10 Months in favor of SuperPATH®.

SuperPATH® vs. Traditional Anterior or Anterolateral Approach: Studies have shown significantly higher HHS scores at Day 7 and 1 Year as well as significantly better Barthel Index scores at 1 Year for SuperPATH®.

SuperPATH® vs. Hardinge Approach: Studies have shown significantly better HHS scores between Day 1 and 3 Years as well as significantly better HSS scores between Day 1 and 6 Months in favor of SuperPATH®. One study reported no differences in HSS scores between 1 Year and 3 Years.

SuperPATH® vs. Other Conventional Approaches: A study has reported significantly better HHS scores at 6 weeks in favor of SuperPATH®; however studies show no differences between 1 Month and 6 Months.

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Comparison of SuperPATH® Outcomes to Other Traditional Surgical Approaches

Patient Reported Outcome Measures (PROMs)



Table 9. Studies Comparing Patient Reported Outcome Measures Between SuperPATH® and Other Approaches for Total Hip Arthroplasty

PROMs	Anterior/ Anterolateral	Posterior/ Posterolateral	Hardinge	"Conventional Approaches"
Studies Showing SuperPATH® is Significantly Better than Other Approaches				
HHS	- Day 7, 1 Mo, 3 Mo [9] - 1 Yr [19]	- Day 1 & 3 [11] - Day 7 [7, 10] - 2 Wks [8] - 1 Mo [7, 8, 10] - 6 Wks [13] - 3 Mo [7, 10, 13, 20]	- Day 1 [21], - 1 & 6 Wks [14], - 3 Mo [14, 21], - 6 Mo, 1 Yr, 2 Yrs, 3 Yrs [21],	- 6 Wks [17]
Barthel Index	- 1 Yr [19]	- Day 1, 3, & 5 [13] - Day 7, 1 Mo, 3 Mo [7]	-	-
SF-36 Scores	-	- 10 Mo [8]	-	-
HSS Scores	-	-	- Day 1, 3 Mo, 6 Mo [21]	-
Studies Showing No Difference Between SuperPATH® and Other Approaches				
HHS	-	- 3 Mo & 1 Yr [20]	-	- 1 Mo [16, 22] - 3 Mo [22] - 6 Mo [18]
Barthel Index	-	-	-	-
SF-36 Scores	-	-	-	-
HSS Scores	-	-	- 1 Yr, 2 Yrs, 3 Yrs [21]	-

HHS: Harris Hip Score; HSS: Hospital for Special Surgery Score; Mo: Month; SF-36: Short-Form Health Survey; Wks: Weeks; Yrs: Years

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Comparison of SuperPATH® Outcomes to Other Traditional Surgical Approaches

Patient Reported Outcome Measures (PROMs)



PROMs – Hemiarthroplasty

PROMs results for studies comparing SuperPATH® and other approaches for hemiarthroplasty are shown in Table 10.

SuperPATH® vs. Traditional Posterior or Posterolateral Approach: Studies have shown significantly better HHS scores between Day 1 and 3 Months in favor of SuperPATH® with no differences between 3 Months and 2 Years. One study reported significantly better Barthel Index scores at Day 7 for SuperPATH®; however, no differences were found at 3 Months and 2 Years.

SuperPATH® vs. Other Conventional Approaches: One study found significantly better HHS scores at 1 Month and 2 Months in favor of SuperPATH®; however, no differences were found at 3 Months.

Table 10. Studies Comparing Patient Reported Outcome Measures Between SuperPATH® and Other Approaches *for Femoral Neck Fracture*

PROMs	Posterior/ Posterolateral	“Conventional Approaches”
Studies Showing SuperPATH® is <i>Significantly Better</i> than Other Approaches		
HHS	- Day 1 [31] - Day 7 [25, 27] - 1 Mo [28, 31] - 6 Wks [30] - 3 Mo [28]	- 1 & 2 Mo [29]
Barthel Index	- Day 7 [25]	-
SF-36 Scores	-	-
HSS Scores	-	-
Studies Showing <i>No Difference</i> Between SuperPATH® and Other Approaches		
HHS	- 3 Mo [25] - 6 Mo [28, 31] - 1 Yr [31] - 2 Yrs [25, 31]	- 3 Mo [29]
Barthel Index	- 3 Mo & 2 Yrs [25]	-
SF-36 Scores	-	-
HSS Scores	-	-

HHS: Harris Hip Score; HSS: Hospital for Special Surgery Score; Mo: Month; SF-36: Short-Form Health Survey

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Comparison of SuperPATH® Outcomes to Other Traditional Surgical Approaches

Economic Benefit of SuperPATH®



Economic Benefit of SuperPATH®

Economic Benefit of SuperPATH® – Total Hip Arthroplasty

As shown in Table 11, studies have shown that overall per-patient costs are lower if the patient underwent a SuperPATH® procedure compared to other surgical approaches. Chow et al. [33] reported use of the SuperPATH® technique resulted in significant overall in-hospital cost reductions of 15% compared to all other approaches within the hospital system between January 2013 and September 2015. Similarly, Gofton et al. [34] reported use of the SuperPATH® technique between April 2013 and January 2014 resulted in overall in-hospital cost reductions of 28.4%. In both studies, SuperPATH® costs were lower than other approaches for patient room and food, physical/occupational therapy, opioids, and transfusions suggesting patients undergoing a SuperPATH® approach have shorter length of stay, require less in-hospital therapy, are in less pain in the hospital, and require transfusions less often.

Table 11. Per Patient Cost Differences Between SuperPATH® and Other Procedures as reported in the literature

Cost Category	Per Patient Percent Difference	
	U.S.: SuperPATH® vs All Other Approaches [33]	Canada: SuperPATH® vs Standard Lateral Approach [34]
Overall Costs	Other +15.0% *	Lateral + 28.4%
Admissions	-	SuperPATH® + 1.9%
Implants	SuperPATH® + 2.8%	-
Costs excluding implants	Other + 36.1% *	-
OR Room	Other + 17.3% *	SuperPATH® + 0.1%
Anesthesia	Other + 79.4% *	SuperPATH® + 13.5%
Patient Room	Other + 26.4% *	Lateral + 60.4%
Patient Food		Lateral + 62.8%
Recovery Room	SuperPATH® + 12.8% *	-
Physical Therapy	Other + 26.8% *	Lateral + 52.5%
Occupational Therapy		Lateral + 88.6%
Social Work	-	Lateral + 92.9%
Pharmacy	Other + 25.3% *	-
Opioids	Other + 49.2% *	Lateral + 42.5%
Imaging	Other + 23.0% *	SuperPATH® 105.9%
Laboratory	SuperPATH® + 3.9%	Lateral + 17.0%
ICU	Other +45.0%	-
Transfusions	Other +88.2% *	Lateral + 92.5%

* p < 0.05; Note: Gofton et al. [34] did not report if differences were statistically significant or not

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Comparison of SuperPATH® Outcomes to Other Traditional Surgical Approaches

Economic Benefit of SuperPATH®



Economic Benefit of SuperPATH® – Hemiarthroplasty

Zhang et al. [31] analyzed two groups of elderly patients who underwent surgery for femoral neck fracture between January 2014 and June 2015 in the Affiliated Hospital of Chengdu University in China: 32 SuperPATH® and 32 posterolateral. Upon other findings, the authors reported that the SuperPATH® group had significantly lower hospitalization costs ($48,544.9 \pm 12,336$ yuan) compared with the posterolateral group ($55,318.9 \pm 10,896.6$ yuan).

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Comparison of SuperPATH® Outcomes to Other Traditional Surgical Approaches

Gait Analysis



Gait Analysis

Zhang [35] published a thesis from Qingdao University in 2018 describing a gait analysis comparing 20 SuperPATH® patients and 20 Hardinge approach patients who underwent THA between May 2015 and December 2016 (Table 12). Compared to patients who underwent the Hardinge approach, SuperPATH® patients had significantly better pace at Day 5 and 4 Weeks and significantly better step size at Day 5. Although the step size at 4 weeks was greater for SuperPATH® compared to patients who underwent the Hardinge approach, the difference was not statistically significant. No differences were found in step frequency out to 12 weeks, in pace at 12 weeks, or in step size at 4 and 12 weeks. The authors concluded that the results suggest SuperPATH® patients moving at a faster pace at Day 5 and 4 weeks demonstrates hip muscle function is recovered quicker in SuperPATH® patients compared to those who underwent a Hardinge approach.

Table 12. Gait comparison study results reported by Zhang et al. [35]

Follow-up Time	SuperPATH® Approach	Hardinge Approach
Pace		
Day 5 *	30.02 meters / minute	26.79 meters / minute
4 Weeks *	37.99 meters / minute	35.95 meters / minute
12 Weeks	44.08 meters / minute	44.27 meters / minute
Step Frequency		
Day 5	64.48 steps / minute	68.77 steps / minute
4 Weeks	75.07 steps / minute	74.78 steps / minute
12 Weeks	83.58 steps / minute	82 steps / minute
Step Size (cm)		
Day 5 *	44.34 cm	38.94 cm
4 Weeks	50.74 cm	48.19 cm
12 Weeks	53.02 cm	54.57 cm

* p < 0.05

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Comparison of SuperPATH® Outcomes to Other Traditional Surgical Approaches

Meta-Analyses



Meta-Analyses

Meta-analyses from China have been reported comparing SuperPATH® to the posterolateral approach (Table 13) or all other conventional approaches (Table 14) for THA.

SuperPATH® vs. Traditional Posterior or Posterolateral Approach: Based on 4 studies in Chinese literature, Sun et al. [36] concluded evidence shows SuperPATH® is significantly better with shorter length of incision and unloaded activity time compared to the posterolateral approach. Additionally, the study concluded the evidence shows no differences for time of operation, intraoperative blood loss, leg length discrepancy (at 3 months), component alignment, and Harris Hip Score at 1 Month and 3 Months.

Table 13. Results from a meta-analysis by Sun et al. meta-analyses in literature comparing SuperPATH® to the Posterolateral Approach

Variable	Sun et al. [36]
# Studies	4 (Chinese Literature)
# Hips (SuperPATH®)	120
# Hips (Conventional)	149
Showed SuperPATH® is Significantly Better than the Posterolateral Approach	
Time of Operation	-
Length of Incision	✓
Intraoperative Blood Loss	-
Leg Length Discrepancy	-
Unloaded Activity Time	✓
Component Alignment	-
Harris Hip Score	-
Showed No Difference Between SuperPATH® and the Posterolateral Approach	
Time of Operation	✓
Length of Incision	-
Intraoperative Blood Loss	✓
Leg Length Discrepancy	✓ (3 Months)
Unloaded Activity Time	-
Component Alignment	✓
Harris Hip Score	✓ (1 & 3 Months)

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Comparison of SuperPATH® Outcomes to Other Traditional Surgical Approaches Meta-Analyses



SuperPATH® vs. Other Conventional Approaches: Meta-analyses have concluded that SuperPATH® is significantly better with shorter length of incision, less postoperative drainage, lower transfusion rates, shorter length of stay, less pain (at day 1, 3, and 7), and better Harris Hip Score (at day 7, 1 month, and 6 weeks). One meta-analysis shows SuperPATH® has significantly less intraoperative blood loss compared to all other conventional approaches while another meta-analysis showed no difference. Evidence from the meta-analyses showed no differences in component alignment or in Harris Hip Score at 3 months.

Table 14. Results from meta-analyses in literature comparing SuperPATH® to all other conventional approaches

Variable	Ge et al. [37] †	Li et al. [38]
# Studies	9 (Chinese Literature)	8 (Chinese Literature*)
# Hips (SuperPATH®)	264	228
# Hips (Conventional)	284	255
Showed SuperPATH® is Significantly Better than Other Conventional Approaches		
Time of Operation	-	-
Length of Incision	✓	✓
Intraoperative Blood Loss	-	✓
Postoperative Drainage	-	✓
Transfusion Rate	✓	-
Mean length of stay	✓	-
Visual Analogue Scale Pain	✓ (Day 1, 3, & 7)	✓ (Day 1, 3, & 7)
Component Alignment	-	-
Harris Hip Score	✓ (Day 7, 1 Month, 6 Weeks)	-
Showed No Difference Between SuperPATH® and Other Conventional Approaches		
Time of Operation	✓	-
Length of Incision	-	-
Intraoperative Blood Loss	✓	-
Postoperative Drainage	-	-
Transfusion Rate	-	-
Mean length of stay	-	-
Visual Analogue Scale Pain	-	-
Component Alignment	✓	✓
Harris Hip Score	✓ (3 Months)	-

† Online first, not peer-reviewed as of June 2019; * Unconfirmed

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Comparison of SuperPATH® Outcomes to Other Traditional Surgical Approaches

Discharge Status and Complications



Discharge Status and Complications

Multiple sources of literature was found providing information for THA patient length of stay, discharge status, and complication rates for THA patients undergoing the SuperPATH® approach as well as the anterior/anterolateral and posterior/posterolateral approaches. As indicated by the data within Table 15 and Table 16 as well as within information previously presented, THA patients undergoing the SuperPATH® approach have a shorter stay in the hospital, are discharged directly home more often, and have lower complication rates compared to the anterior/anterolateral and posterior/posterolateral approaches.

Table 15. THA Patient Discharge Status Comparison Between SuperPATH® and Other Approaches

Variable	SuperPATH® [39]	Anterior / Anterolateral	Posterior / Posterolateral
Mean Length of Stay	1.6 days	2.9 days [40-43]	3.49 days [40-44]
Discharge Status			
Home	91.5%	81.2% [41-43]	70.9% [41-43]
SNF	4.1%	6.9% [42, 44]	10.4% [42, 44]
HHC	4.4%	9.1% [42, 44]	6.4% [42]

Table 16. THA Complication Rate Comparison Between SuperPATH® and Other Approaches

SuperPATH®	Anterior/ Anterolateral	Posterior/ Posterolateral
2.7% - 4.7% [1, 39]	13.1% [40-48]	11.2% [40-44, 46-48]

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Comparison of SuperPATH® Outcomes to Other Traditional Surgical Approaches

List of All Known SuperPath® Comparison Studies



List of All Known SuperPath® Comparison Studies

Table 17. All known literature comparing SuperPath® to other surgical approaches

THA or Hemi	First Author	Study Title	Journal, Book, or University of Thesis	# Patients	URL
SuperPATH® vs. Posterior / Posterolateral Approach					
THA	Xie, J. [7]	Comparison of Supercapsular Percutaneously Assisted Approach versus Conventional Posterior Approach for Total Hip Arthroplasty: a Prospective, Randomized Controlled Trial	Journal of Orthopaedic Surgery and Research	92 (46 SP, 46 Posterior)	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5613398/
THA	Yuan, H. [8]	Comparison of Effectiveness Between SuperPATH approach and Posterolateral Approach in Total Hip Arthroplasty	Repair and Reconstruction of Bones and Joints	84 (40 SP, 44 Posterolateral)	https://www.ncbi.nlm.nih.gov/pubmed/29806358
THA	Li, Zhi [10]	Comparison of the Early Efficacy of Total Hip Joint Replacement Between SuperPATH Approach and Traditional Posterolateral Approach	Journal of Practical Orthopaedics	56 (28 SP, 28 Posterolateral)	www.sygkzz.com/CN/abstract/abstract786.shtml
THA	Wang, Chunsheng [20]	Early Application of Percutaneous Puncture-Assisted Total Hip Approach in Total Hip Arthroplasty	Chinese Journal of Joint Surgery	256 (78 SP, 178 Posterolateral)	http://www.cnki.com.cn/Article/CJFDTotal-ZHGJ201706002.htm
THA	Ouyang, Chenbo [11]	Randomized controlled trial of comparison between the SuperPATH and posterolateral approaches in total hip arthroplasty	Chinese Journal of Reparative and Reconstructive Surgery	24 (12 SP, 12 Posterolateral)	https://www.ncbi.nlm.nih.gov/pubmed/30569673
THA	Wu, Huagui [12]	Comparative Observation of Total Hip Arthroplasty Between SuperPATH	Chinese Contemporary Medicine	100 (50 SP, 50 Posterolateral)	www.cnki.com.cn/Article/CJFDTotal-ZGUD201822028.htm

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Comparison of SuperPATH® Outcomes to Other Traditional Surgical Approaches

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Table 17. All known literature comparing SuperPath® to other surgical approaches

THA or Hemi	First Author	Study Title	Journal, Book, or University of Thesis	# Patients	URL
		Approach and Posterior Lateral Approach			
THA	Xu, Changkui [13]	Early Effect and Application Value of SuperPATH Minimally Invasive Posterior Approach for Total Hip Arthroplasty	Southern Medical University Thesis	52 (31 SP, 21 Posterior)	http://cdmd.cnki.com.cn/Article/CDMD-12121-1018276348.htm
Hemi	Wu, L. [27]	Supercapsular percutaneously-assisted total hip approach for the elderly with femoral neck fractures: study protocol for a prospective, open-label, randomized, controlled clinical trial	Clinical Trials in Orthopedic Disorders	40 (20 SP, 20 Posterior)	http://www.clinicaltrials.com/article.asp?issn=2542-4157;year=2017;volume=2;issue=2;spage=56;epage=62;aulast=Wu
Hemi	Jia, Jianbo [25]	Hip hemiarthroplasty for senile femoral neck fractures: minimally invasive SuperPATH approach versus traditional posterior approach	Injury	100 (50 SP, 50 Posterior)	https://www.injuryjournal.com/article/S0020-1383(19)30337-7/pdf
Hemi	Wu, Guohua [26]	Short-term efficacy of SuperPATH approach for hip arthroplasty in the elderly with femoral neck fracture	Chinese Journal of Multiple Organ Diseases in the Elderly	39 (14 SP, 25 Posterolateral)	www.airitilibrary.com/Publication/alDetailedMesh?docid=zhIndqgjbzz201807011
Hemi	Ding, Bicheng [23]	Clinical analysis of minimally invasive SuperPath approach and traditional posterior hemiarthroplasty in elderly patients with femoral neck fracture	Zhejiang Journal of Trauma Surgery	100 (50 SP, 50 Posterior)	http://www.cnki.com.cn/Article/CJFDTotal-ZJCW201803026.htm
Hemi	Ding, Yantao [30]	Minimally invasive SuperPATH approach for artificial femoral head replacement for the treatment of femoral neck fractures in the elderly	Shenzhen Journal of Integrated Traditional Chinese and Western Medicine	83 (42 SP, 41 Posterolateral)	www.cnki.com.cn/Article/CJFDTotal-SZZX201816064.htm

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Comparison of SuperPATH® Outcomes to Other Traditional Surgical Approaches

List of All Known SuperPath® Comparison Studies



Table 17. All known literature comparing SuperPath® to other surgical approaches

THA or Hemi	First Author	Study Title	Journal, Book, or University of Thesis	# Patients	URL
Hemi	Xialiang, Zheng [28]	Ordinary bipolar femoral head SuperPATH approach for the treatment of femoral neck fractures in the elderly	China Tissue Engineering Research	62 (30 SP, 32 Posterolateral)	www.cnki.com.cn/Article/CJFDTotals-XDKF201819003.htm
Hemi	Zhang, Han [31]	Super PATH minimally invasive hip arthroplasty for treatment of femoral neck fractures in the elderly	Chinese Journal of Orthopaedic Trauma	64 (32 SP, 32 Posterolateral)	wprim.whocc.org.cn/admin/article/articleDetail?WPRIMID=707493&articleId=707978
Hemi	Xu, Guo-fei [24]	SuperPATH minimally invasive approach for artificial femoral head replacement: Short-term follow-up study on the treatment of femoral neck fracture in the elderly	Hainan Medicine Journal	92 (46 SP, 46 Posterolateral)	http://www.hainanyixue.cn/zadmin/auploadfile/zzspdf/20182917/20182917-10.pdf
SuperPATH® vs. Anterior / Anterolateral Approach					
THA	Huang, Wenwen [9]	Comparison of Clinical Efficacy of SuperPATH and Anterolateral Small Incision Approach in THA	Journal of Practical Orthopaedics	80 (40 SP, 40 Anterolateral)	http://www.airitilibrary.com/Publication/alDetailedMesh?docid=sygz201807005
THA	Luo, Jialong [19]	SuperPATH minimally invasive approach for total hip arthroplasty: Analysis of near-and long-term effects of femoral head necrosis	Journal of Clinical Surgery	50 (25 SP, 25 Anterolateral)	http://www.lcwz.com/CN/10.3969/j.issn.1005-6483.2019.04.010
SuperPATH® vs. Hardinge Approach					
THA	Yan, Tingti [14]	Comparison of early effectiveness between SuperPATH approach and Hardinge approach in total hip arthroplasty	Chinese Journal of Reparative and Reconstructive Surgery	154 (64 SP, 90 Hardinge)	https://www.ncbi.nlm.nih.gov/pubmed/29798623
THA	Cui, Penglei [32]	Imaging Evaluation of SuperPATH Minimally Invasive Total Hip Arthroplasty	Qingdao University Thesis	326 (76 SP, 85 Hardinge/Stryker, 83 Hardinge/S&N, 82 Hardinge/Berenger Medical)	cdmd.cnki.com.cn/Article/CDMD-11065-1017840335.htm

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Comparison of SuperPATH® Outcomes to Other Traditional Surgical Approaches

List of All Known SuperPath® Comparison Studies



Table 17. All known literature comparing SuperPath® to other surgical approaches

THA or Hemi	First Author	Study Title	Journal, Book, or University of Thesis	# Patients	URL
THA	Zhang, Bing [35]	Simple gait analysis after total hip arthroplasty with SuperPATH approach and traditional Hardinge approach	Qingdao University Thesis	40 (20 SP, 20 Hardinge)	cdmd.cnki.com.cn/Article/CDMD-11065-1018880699.htm
THA	Ying, Jilin [21]	Mid-term follow-up report of initial minimally invasive total hip arthroplasty	Journal of Practical Orthopaedics	38 (19 SP, 19 Hardinge)	http://www.sygzkz.com/CN/abstract/abstract469.shtml
SuperPATH® vs. Any Conventional Approach					
THA	Chen, Jianlou [15]	Early Effect of SuperPATH Technique on Total Hip Replacement	China Health Standard Management	20 (10 SP, 10 Conventional)	http://www.qikanm.com/index.php?c=content&a=periodicalshow&id=26192903
THA	He, Qixin [16]	Comparison of early curative effect between SuperPath minimally invasive total hip arthroplasty and conventional total hip replacement	Journal of Guangdong Medical College	30 (15 SP, 15 Conventional)	http://www.qikanm.com/index.php?c=content&a=periodicalshow&id=35953206
THA	Yang, Fang [49]	Comparison of the nursing between SuperPath approach and conventional approach in total hip arthroplasty	Zhejiang Clinical Medical Journal	49 (28 SP, 21 Conventional)	unknown
THA	Hou, Jingzhao [17]	Early effect observation of total hip arthroplasty by using SuperPATH technique	Journal of Clinical Orthopaedics	40 (20 SP, 20 Conventional)	http://www.cnki.com.cn/Article_en/CJFDTOTAL-LCGK201701023.htm
THA	Ren, Dongwei [22]	Effect of SuperPath minimally invasive incision total hip arthroplasty on femoral head necrosis and the quality of life	Journal of Hebei Medical University	42 (21 SP, 21 Conventional)	http://en.cnki.com.cn/Article_en/CJFDTOTAL-HBYX201612014.htm
THA	Qiao, Gaoshan [18]	Comparison the early curative effect of SuperPATH and conventional incision for total hip arthroplasty	Biological Orthopedic Materials and Clinical Research	60 (30 SP, 30 Conventional)	http://www.airitilibrary.com/Publication/alDetailedMesh?docid=swgkclcy201801013

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Comparison of SuperPATH® Outcomes to Other Traditional Surgical Approaches

List of All Known SuperPath® Comparison Studies



Table 17. All known literature comparing SuperPath® to other surgical approaches

THA or Hemi	<u>First Author</u>	<u>Study Title</u>	<u>Journal, Book, or University of Thesis</u>	<u># Patients</u>	<u>URL</u>
Hemi	Cai, Zhenhai [29]	Comparison of clinical effects between SuperPath minimally invasive total hip arthroplasty and conventional total hip replacement in the treatment of femoral neck fracture	Zhejiang J Traumat Surg	80 (40 SP, 40 Conventional)	https://caod.oriprobe.com/articles/50898399/superpath_wei_chuang_yu_chang_gui QUAN_zuo_guan_ji.htm

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SuperPATH® Multi-Center Outcomes

Gofton et al. [39] reported information from healthcare databases at three institutions for patients undergoing all primary THAs between January 2013 and July 2014 (Table 18). The 30-day readmission rate was 2.3%, almost half of what was previously reported in the United States (4.2%) [50]. The mean length of stay was 1.6 days, less than half the national average in the United States (3.3 days) [51] and the national median in Canada (5.0 days) as reported in the 2013 Annual Report of the Canadian Joint Replacement Registry for Hip and Knee Replacements. The overall transfusion rate was low (3.3%); however, as expected, the transfusion rate was somewhat variable between sites (0.7-8.0%) because each site had its own anticoagulation and transfusion protocols. The 3.3% transfusion rate is significantly lower than those previously reported in the United States (22.2-25.5%) [52, 53]. As shown in Table 2, Gofton et al. [6] has shown these results can be reproduced across multiple sites by multiple surgeons, even during the learning curve phase.

Table 18. Outcomes from three institutions presented separately and combined as presented by Gofton et al. [39]

Variable	Site 1	Site 2	Site 3	Composite
Number of THAs	152	261	65	479
30-Day Readmission Rate	3.2%	2.0%	1.5%	2.3%
Discharge Status				
Home	95.0%	89.3%	92.3%	91.5%
SNF	5.0%	3.0%	6.1%	4.1%
HHC	-	7.0%	-	3.8%
IRF	-	0.7%	1.5%	0.6%
Transfusion Rate and Length of Stay				
Transfusion Rate	8.0%	0.7%	3.0%	3.3%
Mean Length of Stay	2.0 days	1.4 days	2.1 days	1.6 days
Complications				
Dislocation	1 (0.06%)	2 (0.76%)	1 (1.5%)	4 (0.8%)
DVT	-	1 (0.38%)	-	1 (0.2%)
Fracture	-	3 (1.14%)	1 (1.5%)	4 (0.8%)
Infection	-	-	-	0 (0.0%)
PE	-	-	-	0 (0.0%)

DVT: Deep vein thrombosis; HHS: Home health care; IRF: Inpatient rehabilitation facility; PE: Pulmonary embolism; SNF: Skilled nursing facility;

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SuperPATH® Rapid Recovery Program

In 2017 Dou et al. [54] reported results of 100 patients who underwent a SuperPATH® procedure in which 50 underwent a Rapid Recovery Program (RRP) and 50 did not undergo a RRP. The study reported the RRP group had significantly shorter length of stay than those who did not undergo a RRP. Additionally, the RRP group had better activities of daily living and balance function out to 1 month postoperatively. The authors concluded that SuperPATH® can improve hip function and improve the ability of daily activities in the early postoperative period when combined with an early RRP.

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Conclusions

As demonstrated in this comprehensive review, SuperPATH® can be implemented by non-designer surgeons in different hospital settings, healthcare systems, and annual volumes with short length of stay, high patient discharge status directly home, and without an increase in complication rates. Comparison studies show SuperPATH® has significant advantages over other surgical approaches in terms of shorter length of incision, less intraoperative blood loss, less postoperative drainage, lower transfusion rates, shorter length of stay, less short-term pain, and improved early function as indicated by the Harris Hip Score with no differences in component alignment. Patients undergoing a SuperPATH® procedure have demonstrated that they become Full Function, Faster® demonstrated in studies by significantly better unloaded activity time, timed up and go test scores, and timed stair climb test scores as well as gait parameters at short-term follow-up such as pace and step size. Not only are there advantages in terms of operative variables and short-term patient outcomes, but also studies have shown that SuperPATH® procedures cost significantly less than other procedures as patients have shorter length of stay, require less in-hospital therapy, are in less pain in the hospital, and require transfusions less often.

This comprehensive review illustrates that, by not requiring any muscle releases and preserving the external rotators, patients become fully functioning at a faster rate than with traditional surgical approaches. All of the goals for an ideal tissue sparing approach are satisfied by adoption of the SuperPATH® technique including patient factors such as pain relief, early postoperative function, and improved satisfaction as well as surgeon factors such as being a safe and reproducible procedure, being able to optimally place implants, and minimizing complications. In this rapid recovery orthopedic environment, the unparalleled ability of SuperPATH® to preserve the hip capsule within minimal muscle sacrifice promotes patients becoming Full Function, Faster®.

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References

1. Chow, J., B. Penenberg, and S. Murphy, *Modified micro-superior percutaneously-assisted total hip: early experiences & case reports*. Curr Rev Musculoskelet Med, 2011. **4**(3): p. 146-50.
2. Rasuli, K.J. and W. Gofton, *Percutaneously assisted total hip (PATH) and Supercapsular percutaneously assisted total hip (SuperPATH) arthroplasty: learning curves and early outcomes*. Ann Transl Med, 2015. **3**(13): p. 179.
3. Della Torre, P.K., D.A. Fitch, and J.C. Chow, *Supercapsular percutaneously-assisted total hip arthroplasty: radiographic outcomes and surgical technique*. Annals of translational medicine, 2015. **3**(13): p. 180-180.
4. Howles, S., et al., *EARLY RESULTS AND LEARNING CURVE DATA FOR TOTAL HIP ARTHROPLASTY USING A NOVEL SUPRACAPSULAR TISSUE-SPARING APPROACH "SuperPATH"*. Orthopaedic Proceedings, 2017. **99-B**(SUPP_12): p. 15-15.
5. Qurashi, S., et al., *SuperPATH® minimally invasive total hip arthroplasty - an Australian experience*. Vol. 6. 2016.
6. Gofton, W., et al. *The Learning Curve of a Tissue-Sparing Total Hip Replacement Surgical Technique: a Multi-Centre Assessment*. in EFORT. 2017. Vienna.
7. Xie, J., et al., *Comparison of supercapsular percutaneously assisted approach total hip versus conventional posterior approach for total hip arthroplasty: a prospective, randomized controlled trial*. J Orthop Surg Res, 2017. **12**(1): p. 138.
8. Yuan, H., et al., *Comparison of effectiveness between SuperPATH approach and posterolateral approach in total hip arthroplasty*. Zhongguo Xiu Fu Chong Jian Wai Ke Za Zhi, 2018. **32**(1): p. 14-19.
9. Huang, W., et al., *Comparison of Clinical Efficacy of SuperPATH and Anterolateral Small Incision Approach in THA*. Journal of Practical Orthopaedics, 2018(7): p. 593-596, 604.
10. Li, Z., et al., *Comparison on the Early Efficiency of Total Hip Joint Replacement Between SuperPATH Approach and Traditional Posterolateral Approach*. Journal of Practical Orthopaedics, 2019. **25**(3): p. 266-273.
11. Ouyang, C., et al., *[Randomized controlled trial of comparison between the SuperPATH and posterolateral approaches in total hip arthroplasty]*. Zhongguo Xiu Fu Chong Jian Wai Ke Za Zhi, 2018. **32**(12): p. 1500-1506.
12. Wu, H., *Comparative Observation of Total Hip Arthroplasty Between SuperPATH Approach and Posterior Lateral Approach*. Chinese Contemporary Medicine, 2018(22).
13. Xu, C., *Early Effect and Application Value of SuperPATH Minimally Invasive Posterior Approach for Total Hip Arthroplasty*. 2018, Southern Medical University: Guangzhou General Hospital of Guangzhou Military Region.
14. Yan, T., T. Shaoqi, and W. Yuanhe, *Comparison of Early Effectiveness Between SuperPATH Approach and Hardinge Approach in Total Hip Arthroplasty*. Chinese Journal of Reparative and Reconstructive Surgery, 2017. **1**: p. 17-24.
15. Chen, J., *Analysis of Early Effect of SuperPATH Technique on Total Hip Replacement*. China Health Standard Management, 2017. **8**(17): p. 36-37.
16. He, Q., Q. Jufeng, and L. Yongqing, *Comparison of Early Curvative Effect Between SuperPath Minimally Invasive Total Hip Arthroplasty and Conventional Total Hip Replacement*. Journal of Guangdong Medical College, 2016. **3**: p. 289-292.
17. Hou, J., B. Hongwei, and C. Yanxiao, *Early Effect Observation of Total Hip Arthroplasty by Using SuperPATH Technique*. Journal of Clinical Orthopaedics, 2017. **1**: p. 50-53.
18. Qiao, G., et al., *Comparison the early curative effect of SuperPATH and conventional incision for total hip arthroplasty*. Biological Orthopedic Materials and Clinical Research, 2018(01): p. 52-54.
19. Lou, J., *SuperPATH minimally invasive approach for total hip arthroplasty: Analysis of near-and long-term effects of femoral head necrosis*. Journal of Clinical Surgery, 2019. **27**(4): p. 300-303.
20. Wang, C., et al., *Early application of percutaneous puncture-assisted total hip approach in total hip arthroplasty*. Chinese Journal of Joint Surgery, 2017.

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21. Ying, J., et al., *Mid-term follow-up report of initial minimally invasive total hip arthroplasty*. Journal of Practical Orthopaedics, 2018. **24**(3): p. 268-271.
22. Ren, D., et al., *Effect of SuperPath Minimally Invasive Incision Total Hip Arthroplasty on Femoral Head Necrosis and the Quality of Life*. Journal of Hebei Medical University, 2016. **12**: p. 1416-1419.
23. Ding, B., et al., *Clinical analysis of minimally invasive SuperPath approach and traditional posterior hemiarthroplasty in elderly patients with femoral neck fracture*. Zhejiang Journal of Trauma Surgery, 2018(03).
24. Xu, G., L. Hu, and S. Yang, *SuperPATH minimally invasive approach for artificial femoral head replacement: Short-term follow-up study on the treatment of femoral neck fracture in the elderly*. Hainan Medicine Journal, 2018. **29**(17): p. 2400-2404.
25. Jia, J., et al., *Hip hemiarthroplasty for senile femoral neck fractures: minimally invasive SuperPath approach versus traditional posterior approach*. Injury, 2019.
26. Wu, G., et al., *Short-term efficacy of SuperPATH approach for hip arthroplasty in the elderly with femoral neck fracture*. Chinese Journal of Multiple Organ Diseases in the Elderly, 2018: p. 529-532.
27. Wu, L.-h., B.-q. Yu, and F.-c. Chen, *Supercapsular percutaneously-assisted total hip approach for the elderly with femoral neck fractures: study protocol for a prospective, open-label, randomized, controlled clinical trial*. Clinical Trials in Orthopedic Disorders, 2017. **2**(2): p. 56-62.
28. Xialiang, Z., et al., *Ordinary bipolar femoral head SuperPATH approach for the treatment of femoral neck fractures in the elderly*. China Tissue Engineering Research, 2018(19).
29. Cai, Z., et al., *Comparison of Clinical Effects Between SuperPath Minimally Invasive Total Hip Arthroplasty and Conventional Total Hip Replacement in the Treatment of Femoral Neck Fracture*. Zhejiang J Traumat Surg, 2017. **2**: p. 343-345.
30. Ding, Y., *Minimally invasive SuperPATH approach for artificial femoral head replacement for the treatment of femoral neck fractures in the elderly*. Shenzhen Journal of Integrated Traditional Chinese and Western Medicine, 2018(16).
31. Zhang, H., J. Yuan, and H. Lan, *Super PATH minimally invasive hip arthroplasty for treatment of femoral neck fractures in the elderly*. Chinese Journal of Orthopaedic Trauma, 2018. **20**(5): p. 400-406.
32. Cui, P., *Imaging Evaluation of SuperPATH Minimally Invasive Total Hip Arthroplasty*. 2017, Qingdao University.
33. Chow, J. and D.A. Fitch, *In-hospital costs for total hip replacement performed using the supercapsular percutaneously-assisted total hip replacement surgical technique*. Int Orthop, 2017. **41**(6): p. 1119-1123.
34. Gofton, W. and D.A. Fitch, *In-hospital cost comparison between the standard lateral and supercapsular percutaneously-assisted total hip surgical techniques for total hip replacement*. Int Orthop, 2016. **40**(3): p. 481-5.
35. Zhang, B., *Simple gait analysis after total hip arthroplasty with SuperPATH approach and traditional Hardinge approach*. 2018, Qingdao University.
36. Sun, Z., et al., *Systematic evaluation of the efficacy of SuperPATH approach and posterolateral approach for total hip arthroplasty in the treatment of hip disease*. Chinese Medicine is Bone, 2018(01).
37. Ge, Y., et al., *A systematic review and meta-analysis of SuperPATH approach in total hip arthroplasty*. Journal of Integrative Medicine, 2018: p. Manuscript Under Review.
38. Li, J., B. Qiu, and D. Zhen, *Meta-analysis on clinical outcomes of the SuperPATH approach versus traditional approach in hip arthroplasty*. Chinese Journal of Tissue Engineering Research, 2018. **22**(15): p. 2453-2460.
39. Gofton, W., et al., *Thirty-day readmission rate and discharge status following total hip arthroplasty using the supercapsular percutaneously-assisted total hip surgical technique*. Int Orthop, 2015. **39**(5): p. 847-51.
40. Barrett, W.P., S.E. Turner, and J.P. Leopold, *Prospective randomized study of direct anterior vs postero-lateral approach for total hip arthroplasty*. J Arthroplasty, 2013. **28**(9): p. 1634-8.
41. Bergin, P.F., et al., *Comparison of minimally invasive direct anterior versus posterior total hip arthroplasty based on inflammation and muscle damage markers*. J Bone Joint Surg Am, 2011. **93**(15): p. 1392-8.

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References



42. Martin, C.T., et al., *A Comparison of Hospital Length of Stay and Short-term Morbidity Between the Anterior and the Posterior Approaches to Total Hip Arthroplasty*. The Journal of Arthroplasty, 2013. **28**(5): p. 849-854.
43. Zawadsky, M.W., et al., *Early outcome comparison between the direct anterior approach and the mini-incision posterior approach for primary total hip arthroplasty: 150 consecutive cases*. J Arthroplasty, 2014. **29**(6): p. 1256-60.
44. Rodriguez, J.A., et al., *Does the direct anterior approach in THA offer faster rehabilitation and comparable safety to the posterior approach?* Clin Orthop Relat Res, 2014. **472**(2): p. 455-63.
45. De Geest, T., P. Vansintjan, and G. De Loore, *Direct anterior total hip arthroplasty: complications and early outcome in a series of 300 cases*. Acta Orthop Belg, 2013. **79**(2): p. 166-73.
46. Nakata, K., et al., *A clinical comparative study of the direct anterior with mini-posterior approach: two consecutive series*. J Arthroplasty, 2009. **24**(5): p. 698-704.
47. Sugano, N., et al., *Comparison of mini-incision total hip arthroplasty through an anterior approach and a posterior approach using navigation*. Orthop Clin North Am, 2009. **40**(3): p. 365-70.
48. Taunton, M.J., et al., *Direct anterior total hip arthroplasty yields more rapid voluntary cessation of all walking aids: a prospective, randomized clinical trial*. J Arthroplasty, 2014. **29**(9 Suppl): p. 169-72.
49. Yang, F., L. Zhijun, and X. Jiong, *Comparison of the Nursing Between SuperPath Approach and Conventional Approach in Total Hip Arthroplasty*. Zhejiang Clinical Medical Journal, 2017. **19**: p. 1158-1159.
50. Pugely, A.J., et al., *Incidence of and risk factors for 30-day readmission following elective primary total joint arthroplasty: analysis from the ACS-NSQIP*. J Arthroplasty, 2013. **28**(9): p. 1499-504.
51. HCUPnet, A. Agency for Healthcare Research and Quality *H-CUPnet Database, ICD-9-CM Code 81.51 for United States in 2011*. 2012 04 September 2014]; Available from: <http://hcupnet.ahrq.gov/HCUPnet.jsp>.
52. Mednick, R.E., et al., *Factors Affecting Readmission Rates Following Primary Total Hip Arthroplasty*. J Bone Joint Surg Am, 2014. **96**(14): p. 1201-1209.
53. Yoshihara, H. and D. Yoneoka, *National trends in the utilization of blood transfusions in total hip and knee arthroplasty*. J Arthroplasty, 2014. **29**(10): p. 1932-7.
54. Dou, X.-F., et al., *Application of rapid rehabilitation intervention in SuperPATH minimally invasive total hip arthroplasty*. Nursing and Rehabilitation, 2017(02).

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